

# PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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 (72) Inventor WILLIAM JOSEPH CLAYTON



## (54) PERMEABLE THERMOPLASTIC FILM PRODUCT AND MATERIAL

(71) We, MOBIL OIL CORPORATION, a Corporation organised under the laws of the State of New York, United States of America, of 150 East 42nd Street, New York, New York 10017, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an improved method for employment in the manufacture of novel thermoplastic film products which have controlled gas or vapor transmission ratios and which are likewise impervious, or at least substantially resistant, to the transmission of liquids or solids therethrough. Such film materials have found numerous end use applications, for example in the fabrication of bags or film material suitable for the packaging of moisture-emitting fresh produce or meats. Other applications for such permeable films include clothing such as raincoats, liners, baby-pant materials, filters, construction film upholstery and many others.

More particularly, the present invention is concerned with a method for the treatment of thermoplastic film in such a manner as to increase the permeability thereof. This may be accomplished, in accord with one embodiment of the process of the present invention, by forming holes or perforations in selected areas of the total surface subject to the pressure application of a coated abrasive surface either with or without the employment of elevated temperatures. Such a method results in the formation of permeable films of high mechanical strength and characterized by having a relatively uniform distribution of micropores formed in films produced in accord with a particular embodiment of the present method are characterized by having a peripheral beaded area immediately surrounding the perforation, e.g. when heat is employed during the perforating operation.

The present invention, therefore, provides a method for producing permeable thermoplastic film, which comprises contacting the surface of a thermoplastic film with a surface coated

with abrasive grains under sufficient pressure to cause individual abrasive grains to penetrate the surface of the film so as to form a film of increased permeability to gases and vapors but substantially impervious to liquids or solids.

In the past, numerous methods have been proposed for the production of films such as thermoplastic films which have been perforated to increase the permeability thereof to gases and/or vapors while inhibiting the passage therethrough of liquids. Such a method is disclosed in U.S. Patent No. 2,689,379 wherein a process for perforating thermoplastic films is described which employs a hot metallic screen or a hard surface engraved with a screen grid pattern. It has been found, however, that when a film is perforated employing the process described therein, the resultant film product, although somewhat resistant to the passage of liquids such as water for example, will allow such liquids to penetrate with the application of very light pressure. Further, once water has been forced through such a film product, the holes therein are easily ruptured becoming quite enlarged and, after that, water will literally run through such a product like a screen. Further, when thermoplastic films are perforated employing such a screen grid, the resultant perforations are characterized by having extremely thin film portions around the periphery of the hole formed at the point of the intersecting wires comprising the screen grid. Such an extremely thin portion of film is quite undesirable in the case of thermoplastic films which contain plasticizer, employed to improve the flexibility of such films. The plasticizer in such thin film areas has a tendency to be washed out very rapidly during repeated washing cycles of such a film product resulting in such thinned out areas immediately surrounding the holes becoming so embrittled that they break off during normal usage of such a product. Additionally, it has been found that most thermoplastic films such as polyethylene for example, when perforated utilizing a wire screen grid in a continuous inline perforating operation, have a tendency to stick to the metallic surface of such a screen

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grid which further interferes with and frequently precludes a smooth continuous perforating operation.

U.S. Patent No. 3,073,304 discloses a method of perforating thin thermoplastic films by passing such films through the nip formed by a pair of rollers. One of the rollers is a heated, smooth surfaced hard roller and the other a knurled or etched roller having a plurality of projections in the surface thereof for perforating the films. In addition to the obvious economic disadvantages attendant to the employment of engraved metallic rollers in such a process, there are control problems such as the tendency of the metallic projections to overheat and stick to the surface of the film due to the inherent high heat conductivity of such metal surfaces. Also, there is a natural tendency of such projections to be rapidly dulled by virtue of the continual pressure contact against the smooth surfaced roller thereby necessitating frequent replacement of the perforating roller.

Additionally and as noted in U.S. Patent No. 3,073,304, thermoplastic films, such as for example polyvinyls, in the absence of special back-up sheets or protective layers, have a tendency to deform and shrink when heated to the temperatures which are required to perforate such films. When attempts are made to internally cool such engraved metallic rollers in an attempt to dissipate heat from the surface projections thereon, it has been found that rapid heat dissipation from the heated smooth surfaced roller also occurs and usually results in either no or unsatisfactory film perforating.

In accordance with one embodiment of the present invention there is provided a method for increasing the permeability of thermoplastic films which comprises passing either single or multiple layers of films into the nip formed by a pair of counter-rotating rollers. One of the rollers, hereinafter referred to as the perforating roller, carries on its surface a layer, preferably a substantially evenly distributed layer, of an abrasive material such as for example a garnet or an aluminum oxide type of abrasive. The other roller hereinafter referred to as the pressure roller, presses the thermoplastic film into contact with the abrasive coated surface of the perforating roller. The film is subsequently removed from the perforating roller utilizing a suitable take-off roller and finally is passed to a wind-up operation.

The invention will be further illustrated with reference to the accompanying Drawings, in which:

Figure 1 is a diagrammatic view of one form of apparatus which may be employed in the method of the present invention.

Figure 2 is an enlarged reproduction of a photomicrograph of a thermoplastic film perforated in accord with the method of the present invention.

Figure 3 is an enlarged reproduction of a photomicrograph which illustrates a cross section through a single perforation in a section of a thermoplastic film which has been perforated in accord with the method of the present invention.

Figures 4a through 4d inclusive are enlarged diagrammatical representations of an individual film layer being perforated in accord with one embodiment of the method of the present invention.

Figure 5 is a diagrammatic view of another form of apparatus which may be employed in the method of the present invention.

Figure 6 is an overhead view of roller 13A illustrated in Figure 5.

Figure 7 is a fragmentary cross-sectional view of roller 13A taken on line 7-7 of Figure 6.

Figure 8 is an overhead view of another form of perforating roller which may be employed with the apparatus illustrated in Figure 5.

Figure 9 is a schematic illustration of fresh fruit contained in a support tray which has been overwrapped utilizing the film product produced in accord with the method of the present invention.

It has been found that the semi-permeable film produced in accord with the method of the present invention is particularly useful for the packaging of fresh produce and fruits and the like. Semi-permeable film is a film which is relatively impervious to the passage of liquids such as water therethrough but allows passage of gases such as oxygen therethrough at a rate greater than, e.g. non-perforated thermoplastic film or film which has not been treated in accord with the method of the present invention.

Fruits and vegetables are generally harvested slightly before or at the time of ripening. They continue to live for a period of time which may vary from a few days to several months after which time the onset of senescence will occur. A reduction in temperature of most fruits and vegetables will slow down the living process and hence is a factor towards lengthening the span of time intermediate the harvesting and onset of senescence. However, in the case of some fruits such as bananas, for example, the side effects resulting from the reduction of temperature, in an attempt to preserve are more deleterious to the fruit than non-refrigerated storage. It is known that the ideal relative humidity for the storage of fruit and vegetables differs with the individual type of produce but generally falls in the range of from about 85% to about 95%. It has been found that when thermoplastic films which have been treated to increase the permeability thereof in accord with the method of the present invention, are employed in the overwrap packaging of fresh produce, the storage life of such goods is effectively prolonged as a re-

sult of the overwrap packaging material which maintains a relatively constant and optimum relative humidity within the package; controls the amount of carbon dioxide emitted from the fresh produce as a result of their respiratory cycle; and limits the amount of oxygen which is allowed to penetrate into the package from the exterior atmosphere.

A preferred embodiment of the present process comprises applying pressure, either with or without the application of heat to a thermoplastic film positioned between two surfaces one of which is coated with abrasive material which is maintained at a temperature of from about 50°F. to about 120°F. and preferably about 70°F., and the other surface comprising a smooth or sand-blasted surface maintained either at room temperature or at elevated temperatures, i.e. above the softening point of the thermoplastic material being perforated. In accordance with the present method, the smooth surface roller, by variation of the temperature thereof, causes a resultant variation in the type of permeable film structure which is produced as will be more fully explained hereinafter.

In an application where it is desired to perforate either single or multiple layers such as for example a flattened tube of such film, the smooth surface roller may be maintained at room temperature, i.e. about 70°F. and under such conditions a mechanical punching or perforating of the thermoplastic film will result as a result of the individual abrasive grains present on the abrasive coated roller penetrating through the film and forming micropores therein. The periphery of the perforated portion of such film is characterized by having a slightly thinned area immediately surrounding the hole.

In accordance with the present method, it has also been found that single layers of thermoplastic film may be perforated by operating with the temperature of the smooth surface roller maintained at temperatures above room temperature and preferably above the softening point of the thermoplastic material to be perforated. As more clearly illustrated in Figures 4a through 4d, when elevated temperatures on the smooth surface roller are employed, i.e. temperatures above the softening point of the thermoplastic film, the surface of the film which is adjacent to and in contact with the hot smooth surface is near or above its melting point whereas the opposite surface of the film, i.e. that surface of the film which initially comes into contact with the abrasive coated roller is relatively cool. As pressure is applied to the thermoplastic film by bringing together the abrasive coated surface with the hot smooth surface, the abrasive grains are pressed through the plastic film layer to a point on the opposite side of the film adjacent the hot smooth surface. The relatively high temperature of the upper surface of the film causes softening of the plastic and hence rela-

tively easy penetration of the grain. Immediately after the tip of the grain comes into contact with the heated smooth surface, the pressure on the hot surface is removed by virtue of the continuous rotation of the abrasive coated surface roller and the lower part of the film is raised on the grain due to contraction of the lower surface of the film. The film is lifted by virtue of such contraction in an amount sufficient to relieve any tension which may be on the film which, for example, in the case of 4 mil film is a little over 2 mils. At the instant that the grain penetrates the film, the top surface of the film is melted and sticks slightly to the tip of the grain. Hence, as the bottom of the film is caused to rise, the top is pulled down forming a small somewhat conical opening.

It has been found that films, heat-perforated in accordance with the foregoing technique, are characterized by having an annular bead which completely surrounds each minute opening formed by the abrasive grains penetrating the film. The beads (or grommets) are formed as a result of the viscoelastic nature of the plastic material which has a tendency to recede from each abrasive grain as it penetrates the heated film. These annular beads or grommets result in the perforated film product being characterized by having an improved tear resistance, as compared to cold perforated film material, in that once a tear is initiated in the perforated film, the thick annular beads or grommets in the path of such a tear have a tendency to retard, or stop completely, further propagation of the tear.

As hereinbefore indicated, a variety of abrasives may be employed on the perforating roller employed in the present method. Although the perforating roller may be directly coated with abrasive materials, which may be adhesively secured thereto, it has been found preferable to employ coated abrasives, commonly referred to as sandpaper, due to the ease of application to the roller surface, e.g. the abrasive coated paper or cloth may be simply adhesively secured around the surface of the perforating roller.

For purposes of the present invention it is not necessary that the entire surface of the perforating roller be covered with an abrasive material. Moreover, depending upon the type of permeable film product desired, it is sometimes desirable to use small or discrete, non-continuous areas of coated abrasive on the perforating roller, separated by areas with no abrasive. Film products produced with such a perforating roller will have patterned areas of increased permeability, said pattern corresponding to the pattern of the abrasive carried on the surface of the perforating roller.

Permeable film structures may be produced in accordance with the present invention, with hole sizes which may vary from less than about 0.5 mil in diameter up to about 8 to 10 mils

in diameter and larger depending upon the desired end use application of the film product being produced.

5 The individual hole size, which determines the porosity of the final film product, is directly dependent upon the size of the individual abrasive grains employed in the abrasive coated roller; the amount of pressure applied to the nip of the counter-rotating perforating roller and the smooth surfaced roller; and in  
10 perforating operations where heat is employed on the smooth surfaced roller, the amount of heat employed influences the hole size of the permeable films. If the temperature of the  
15 smooth surfaced roller is below the softening point of the thermoplastic film being perforated, a mechanical perforation of the film occurs resulting in hole sizes of a fairly low magnitude whereas if the temperature of the smooth  
20 surfaced roller is maintained above the softening point of the thermoplastic film, an increase in the individual hole size results, the higher the temperature the larger the resultant hole size.

25 In the embodiment of the method and apparatus of the present invention as illustrated in Figure 1, a single continuous layer of thermoplastic film 11 is fed from supply roller 12 onto the surface of rotating perforating roller 13. The surface of perforating roller 13  
30 is covered with a continuous (or non-continuous) layer of abrasives, preferably coated abrasives such as a garnet type sandpaper for example, adhesively secured to the surface of  
35 roller 13. The coated abrasive may or may not cover the periphery of roller 13 depending upon the type of permeable film product desired and as hereinbefore discussed. After having passed onto the surface of abrasive covered  
40 roller 13, film 11 is carried by virtue of rotation of perforating roller 13 initially into the nip formed by perforating roller 13 with low pressure roller 14 (optional) and subsequently thereafter into the nip of high pressure roller  
45 16 with perforating roller 13. The surface of low pressure roller 14 and high pressure roller 16 may be heated, for example, by the employment of infrared heat sources 15 positioned adjacent thereto. The smooth surfaced rollers 14  
50 and 16 are preferably maintained at a temperature above the softening point of the particular film which it is desired to perforate. It is preferable to maintain the temperature of the film in contact with the coated abrasive  
55 surface of roller 13 at a temperature below about 120°F. and preferably as low as 70°F. and below. After the film passes through the nip formed by perforating roller 13 with high pressure roller 16, the perforated film is removed from the roller 13, for example by the  
60 employment of rotating take-off roller 17, and the film is subsequently passed to a wind-up roller 18 or onto further processing, for example a bag-making operation. It has been found  
65 that the coated abrasive, heat-perforating tech-

nique as aforescribed is preferable for employment with single layer films. This is primarily due to the fact that by virtue of the relatively hard metallic surfaces of high pressure roller 16 and perforating roller 13, when  
70 multiple layers of film are perforated by passing them into the nip formed by the rotating heated pressure rollers with the cold perforating roller 13, such multiple layers of film have a tendency to fuse or block together in those  
75 areas where they are heat perforated with the coated abrasive grains.

In another embodiment of the method of the present invention, when it is desired to cold-perforate multiple layers of film as aforescribed, whereby a mechanical perforation of each of the layers occurs, rather than the grommet encirclement of individual perforations as aforescribed, the heating elements  
80 15 need only to be removed and pressure rollers 14 and 16 allowed to run cool or at ambient temperatures.

In a further embodiment of the film treatment method of the present invention high pressure roller 16 is covered with, or fabricated from, a resilient material. For example, materials such as silicone sponge covering have been found desirable. Heat is applied, either  
90 externally as illustrated in Figure 1 with external heat source 15, or internally (not shown) for example by the circulation of heated fluids internally of roller 16.

It has been found that when high pressure roller 16 is fabricated from, or covered with, a resilient material such as silicone sponge, for example, the resultant film product exhibits increased permeability, however, the abrasive roller does not act upon the film to result in a film product which has holes formed completely through the film. The resultant product  
100 does, however, have a very thin membrane-like film at each point therein which corresponds to the tip of each of the abrasive grains which penetrate the film during its passage through the nip formed by the resilient pressure roller 16 and perforating roller 13. Such a film product is useful for the production of produce bags exhibiting increased moisture vapor transmission ratios and, simultaneously, by  
105 virtue of the fact that the film surface has not been completely penetrated by the abrasive grain, such a film product will prevent the passage therethrough of liquids such as water or extraneous solid contaminants. Additionally, it has been found that such a resilient surface on high pressure roller 16 is also desirable for high speed commercial operations. The resiliency of the surface of pressure roller 16 aids in the prevention of film tearing and damage as the film passes through the nip, which  
110 damage may occur for example as a result of unevenness or non-uniformity of curvature of rollers 13 and 16.

The following examples are employed to illustrate certain specific embodiments of the  
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perforating and film treatment techniques employed in accord with the method of the present invention as aforedescribed and accordingly should not be construed in a limitative sense.

#### EXAMPLE 1

##### Heated Non Resilient Pressure Roller

A continuous polyvinyl chloride film, 3.75 mils thick, was continuously fed from supply roller 12 at a rate of about 20 ft. per minute, onto the surface of perforating roller 13. Perforating roller 13 was completely covered with an 80 grain garnet abrasive paper adhesively secured thereto. The vinyl film was carried around the surface of rotating perforating roller 13, through the nip formed by low pressure roller 14, and subsequently into the nip formed by high pressure roller 16 pressing against perforating roller 13. The pressure at the nip between rollers 13 and 16 was approximately 40 lb. per square inch. High pressure roller 16 had a smooth aluminum surface which was heated to a temperature of 280°F. utilizing infrared heat source 15. After emerging from the nip formed by pressure roller 16 and perforating roller 13, the film was removed from roller 13 utilizing rotating take-off roller 17 and subsequently passed to wind-up on rewind roller 18.

The polyvinyl chloride film produced in accord with Example 1 was found to have at least a tenfold increase in the moisture vapor transmission ratio thereof in comparison to an unperforated film of identical thickness composition. The perforated film was also found to serve as an effective barrier to the transmission of liquid, such as water, therethrough. The material produced in accord with Example 1 has been successfully used in the fabrication of baby-pants.

#### EXAMPLE 2

##### Heated Non Resilient Pressure Roller

A continuous polyethylene film, 1 mil thick, was continuously fed from supply roller 12 at a rate of about 20 ft. per minute onto the surface of perforating roller 13. Perforating roller 13 was covered with a 120 grain garnet abrasive paper adhesively secured thereto, comprising individual abrasive discs 1/4" in diameter and spaced on one inch centers in a random pattern. The polyethylene film was carried around the surface of rotating perforating roller 13 through the nip formed by low pressure roller 14 and subsequently into the nip formed by high pressure roller 16 pressing against perforating roller 13. The pressure at the nip between rollers 13 and 16 was approximately 40 lb. per square inch. High pressure roller 16 had a smooth aluminum surface which was heated to a temperature of 280°F. utilizing infrared heat source 15. After emerging from the nip formed by pressure roller 16 and perforating roller 13, the film was removed from roller 13 utilizing rotating take-off roller 17

and subsequently passed to wind-up on rewind roller 18.

The polyethylene film produced in accord with Example 2 was found to have at least a tenfold increase in the moisture vapor transmission ratio thereof, in comparison to an unperforated film of identical thickness and composition. The perforated film was also found to serve as an effective barrier to the transmission of liquid, such as water, therethrough. Such a material has been found to be useful in the fabrication of produce bags.

#### EXAMPLE 3

##### Unheated Non Resilient Pressure Roller

A continuous polyethylene film, 1 mil thick, was continuously fed from supply roller 12 at a rate of about 20 ft. per minute onto the surface of perforating roller 13. Perforating roller 13 was covered with a 120 grain garnet abrasive paper adhesively secured thereto. The polyethylene film was carried around the surface of rotating perforating roller 13 through the nip formed by low pressure roller 14 and subsequently into the nip formed by high pressure roller 16 pressing against perforating roller 13. The pressure at the nip between rollers 13 and 16 was approximately 20 lb. per square inch. High pressure roller 16 had a smooth aluminum surface which was maintained at room temperature or approximately 70°F. After emerging from the nip formed by pressure roller 16 and perforating roller 13, the film was removed from roller 13 utilizing rotating take-off roller 17 and subsequently passed to wind-up on rewind roller 18.

The polyethylene film produced in accord with Example 3 was found to have at least a tenfold increase in the moisture vapor transmission ratio thereof in comparison to an unperforated film of identical thickness and composition. The perforated film was characterized by having micropores therein, the edges of which were relatively thin in comparison to the adjacent film thicknesses. Further, the periphery of the micropores were not circumscribed by grommets of relatively thick molten thermoplastic as was the case with the periphery of micropores present in the film produced in accord with Examples 1 and 2.

#### EXAMPLE 4

##### Heated Resilient Pressure Roller

A continuous polyethylene film, 1 mil thick, was continuously fed from supply roller 12 at a rate of about 20 ft. per minute onto the surface of perforating roller 13. Perforating roller 12 was covered with a 120 grain garnet abrasive paper adhesively secured thereto. The polyethylene film was carried around the surface of rotating perforating roller 13 through the nip formed by low pressure roller 14 and subsequently into the nip formed by high pressure roller 16 pressing against perforating roller 13. The pressure at the nip between rollers 13 and 16 was approximately 20 lb.

per square inch. High pressure roller 16 had a resilient surface comprising a silicone sponge material which was adhesively secured to the surface of roller 16. The resilient surface of roller 16 was heated to a temperature of 140°F. utilizing infrared heat source 15. After emerging from the nip formed by pressure roller 16 and perforating roller 13, the film was removed from roller 13 utilizing rotating take-off roller 17 and subsequently passed to wind-up on rewind roller 18.

The polyethylene film produced in accord with Example 4 was found to have at least a tenfold increase in the moisture vapor transmission ratio thereof, in comparison to an untreated film of identical thickness and composition. The film produced in accord with Example 4 was further characterized in that the perforations formed by the tips of the abrasive grains did not extend completely through the film thickness. Extremely thin membranes of film material, corresponding to the positions of the penetration by the individual abrasive grain, were found to exist in each area of perforation. The moisture vapor transmission ratio of film produced in accord with Example 4 was relatively lower in comparison to that of the films produced in accord with Examples 1 through 3.

In accordance with another specific embodiment of the method of the present invention, it has been found that films with a high degree of permeability, i.e. permeabilities on the order of at least 100 cc./sq. c./min. may be produced utilizing abrasive coated surface characterized by the abrasive coating material being arranged in strips on the periphery of the roller whereby there is spacing adjacent either side of the abrasive coated strips.

#### EXAMPLE 5

##### Unheated Resilient Pressure Roller— Discontinuous Coated Abrasive Surface

A continuous polyethylene film 11A, 1 mil thick, was continuously fed from supply roller 12A (see Figure 5) at a rate of about 20 feet per minute, under idler roller 19, and onto the surface of perforating roller 13A. Roller 13A was a 6-inch diameter steel roll covered with a parallel series of 1/8 inch wide strips 13B of coated abrasive (aluminum oxide-grain size 36) spaced 1/8 inch apart and positioned parallel to the direction of film advancement. The film 11A was passed into the nip formed by roller 13A and counter rotating roller 16A. Roller 16A was a 2-inch diameter silicone sponge coated roll. In the nip, the pressure of the silicone sponge anchored the polyethylene film onto the tips of the abrasive grains carried on the surface of the 1/8 inch wide strips. Simultaneously, the film was stretched into the cavities between the strips 13B and the resultant stretching pulled large holes into the film. The perforated film was continuously withdrawn from the nip formed by rollers 13A and 16A and was taken up on rewind roll 18A.

Thus, it will be seen that in accordance with preceding Example 5, thermoplastic film was perforated utilizing a process whereby perforation is effected by pulling of the film over the abrasive granules, which, in turn, causes penetration of the abrasive granules into the film by the process of the sponge covering on roller 16A pushing the film down into the cavities between the abrasive coated strips 13B.

It has been found that in accordance with the preceding Example 5, suitable perforation of the film is accomplished utilizing parallel strips of abrasive coated material approximately 1/8 inch wide. Narrower abrasive strips may also be employed. However, it has been found that when the width of the abrasive coated strips exceeds about 1/4 inch, penetration of the film by the abrasive granules was unsatisfactory.

As shown in Figure 8, the arrangement of the spaced, abrasive coated strips on the surface of perforating roll 13A may be perpendicular to the direction of film advancement over satisfactory perforation of the film, as the arrangement is equally effective in achieving a satisfactory perforation of the film, as the arrangement of strips 13B illustrated in Figure 6.

Film produced in accord with the method described in Example 5, in addition to its utility as a fresh produce overwrap packaging material, has been found particularly suitable for employment as a banana shroud material. Banana shrouds are employed to protect stalks of bananas as they are growing. Generally, when employing thermoplastic shrouds for this purpose, relatively large ventilation holes must be punched in the film to create a chimney effect to insure proper oxygen supply to the growing stalk of fruit. It has now been found that such protective shrouds may be formed utilizing the permeable film material produced in accord with the preceding example whereby the stalk may be completely encased in such film. As a result of the film's relatively high permeability, such complete encasement does not interfere with the normal growth of the fruit. Moreover, complete encasement results in elimination of insects attacking the fruit as well as excluding spores from settling on the fruit during the growing process. Such advantages were not derived from the prior art ventilated shrouds formed from non-perforated thermoplastic film materials.

Although the present invention has been described with preferred embodiments, it is to be understood that modifications and variations may be resorted to, without departing from the scope thereof, as those skilled in the art will appreciate. Such variations and modifications are therefore considered to be within the purview and scope of the appended claims.

#### WHAT WE CLAIM IS:—

1. A method for producing permeable ther-

- 5 moplastic film, which comprises contacting the surface of a thermoplastic film with a surface coated with abrasive grains under sufficient pressure to cause individual abrasive grains to penetrate the surface of the film so as to form a film of increased permeability to gases and vapors but substantially impervious to liquids or solids.
- 10 2. A method according to claim 1 in which the individual abrasive grains penetrate the film completely.
- 15 3. A method according to claim 1 or 2 in which the film is contacted with the surface of a roller coated with abrasive grains as the surface coated with abrasive grains.
- 20 4. A method according to claim 3 in which the film is fed into the nip of a pair of rollers, one being the roller with the surface coated with abrasive grains, the other being pressure roller.
- 25 5. A method according to claim 4 in which the film is passed successively through two such nips, the nip pressure being greater in the second nip than the first.
6. A method according to claim 4 or 5 in which the pressure roller has a resilient surface.
7. A method according to any of claims 3 to 6 in which the surface of the roller coated with the abrasive grains is coated partly with the abrasive grains in discontinuous areas.
8. A method according to claim 1 substantially as herein described with reference to any of the Examples.
9. A method according to claim 1 substantially as herein described with reference to and as shown in Figures 1 to 8 of the accompanying drawings.
10. A permeable thermoplastic film produced by a method claimed in any of claims 1 to 9.
11. A method of packaging fresh product and meat products which comprises supporting said products on a support tray member, and overwrapping said product on said support tray with a permeable thermoplastic film as claimed in claim 10.
12. A wrapping for a package containing a fresh comestible, which wrapping comprises a permeable thermoplastic film, as claimed in claim 10.
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MICHAEL BURNSIDE & COMPANY,  
Chartered Patent Agents,  
36 Westminster Palace Gardens,  
Artillery Row, London, S.W.1.  
Agents for the Applicants.

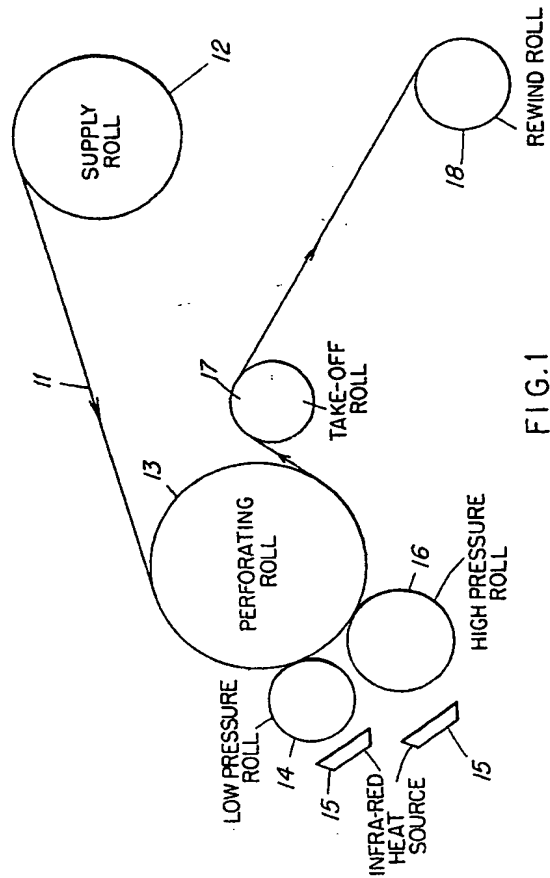


FIG. 1



1270777 COMPLETE SPECIFICATION

4 SHEETS

*This drawing is a reproduction of  
the Original on a reduced scale*

Sheet 2

FIG. 2

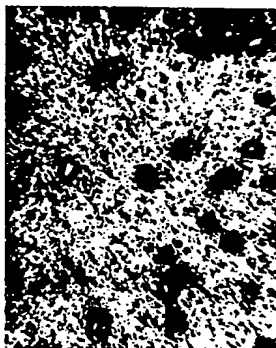


FIG. 3

